SCIENCE FOCUS: VOLCANOES

SeaWiFS Views Volcanoes

SeaWiFS was in just the right place, at just the right time, to capture this view of the ash plume from an eruption of Mount Etna in Sicily. Mount Etna is a huge (3310 m high) volcano, the largest volcano in Europe. While it has produced some voluminous flank eruptions that have threatened nearby towns, Etna commonly has activity only in its summit craters. Since 1997, there has been episodic activity at Etna's summit. In the past few months, in intervals as short as 12 hours or as long as 10 days, there have been remarkable eruptions when large lava fountains have jetted from Etna's Southeast Crater. While these eruptions are short-lived, they are also spectacular. At night, the lava fountains can be seen from vantage points all around the island, often up to 100 km away from the summit. If an eruption takes place during the day, the ash cloud can also be seen from a great distance.

On April 6, 2000, a summit eruption took place just before noon. (Stromboli On-Line provides spectacular images of other eruptions during this period). SeaWiFS passed over the Mediterranean just as the eruption was ending, as the large cloud of ash was drifting eastward. This image appears "pixelated", i.e., the clouds appear somewhat square, because Sicily was near the edge of the SeaWiFS observation swath. Due to the curvature of the Earth and the observation angle, the resolution of this area of the image is degraded compared to the center of the swath, where the resolution is 1 km.

Though the primary mission of SeaWiFS is to obtain views of the ocean, SeaWiFS has also provided observations of atmospheric aerosols. The first *Science Focus!* chapter was on the subject of observations of a dust storm in China. SeaWiFS data is also useful for detecting smoke from ground fires, and as shown above and below, it can detect plumes of ash and steam from volcanoes.

Volcanoes do not usually have a direct influence on the biological activity of surrounding oceans. But they can have an indirect influence, if an eruption is large enough. Fine dust and sulfur aerosols from the massive eruption of Mt. Pinatubo in 1991, distributed around the world in the stratosphere, reduced the amount of sunlight reaching the ocean surface. This reduction in *insolation* reduced both the sea surface temperature and the primary productivity in the tropical Pacific Ocean for several months.

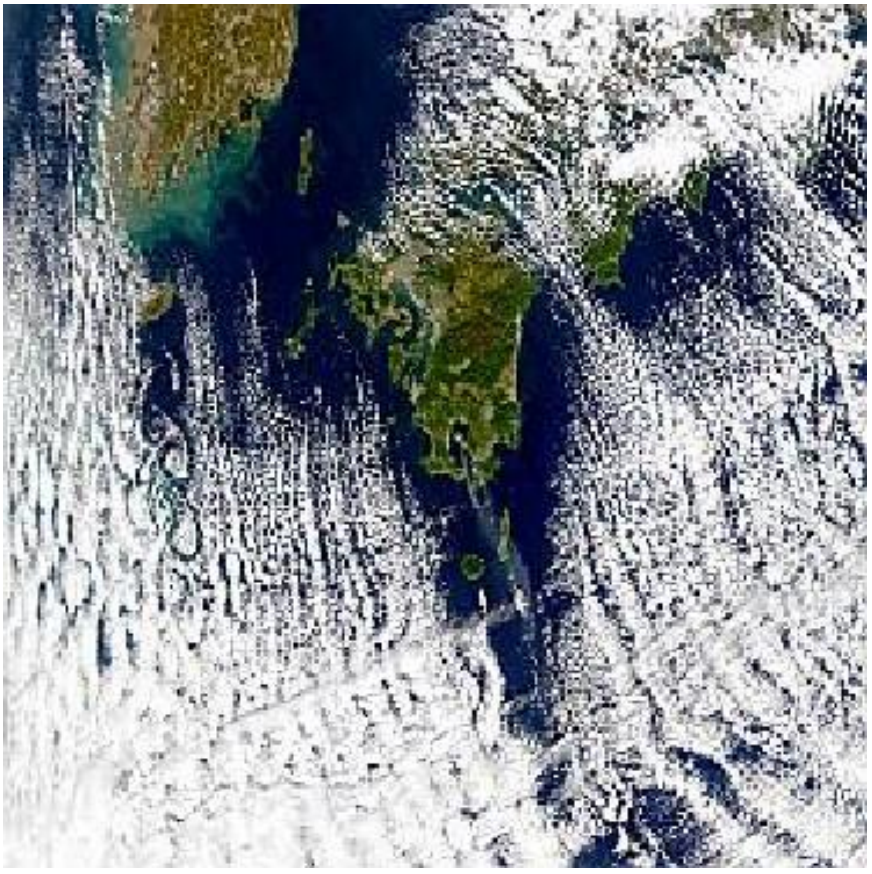
Iron from ash deposited on the ocean floor around volcanic islands can also nourish productivity in iron-deficient waters. The plume of phytoplankton productivity that is frequently found near the Galapagos Islands (subject of a CZCS *Classic Scenes* chapter) is the best example of this phenomenon. During the eruption of the new volcanic island Surtsey off of Iceland, dissolved silicate concentrations were elevated in surrounding waters, and this led to augmented phytoplankton productivity near the eruption. Silica is a vital nutrient for diatoms, a form of phytoplankton, which form delicate microscopic shells of silica.

• Note: This article was written in the year 2000. In 2008, a strong and brief eruption of the Aleutian island volcano Kasatochi released enough iron-rich ash over the Pacific Ocean to stimulate a phytoplankton bloom.

Here are some other views of volcanic plumes from SeaWiFS:

Sakura-Jima Volcano, Japan

Note the light-colored plume drifting southward from the volcano into the clear area, and to the west, a pretty display of von Karman vortices in the clouds. This image was acquired on December 6, 1999.



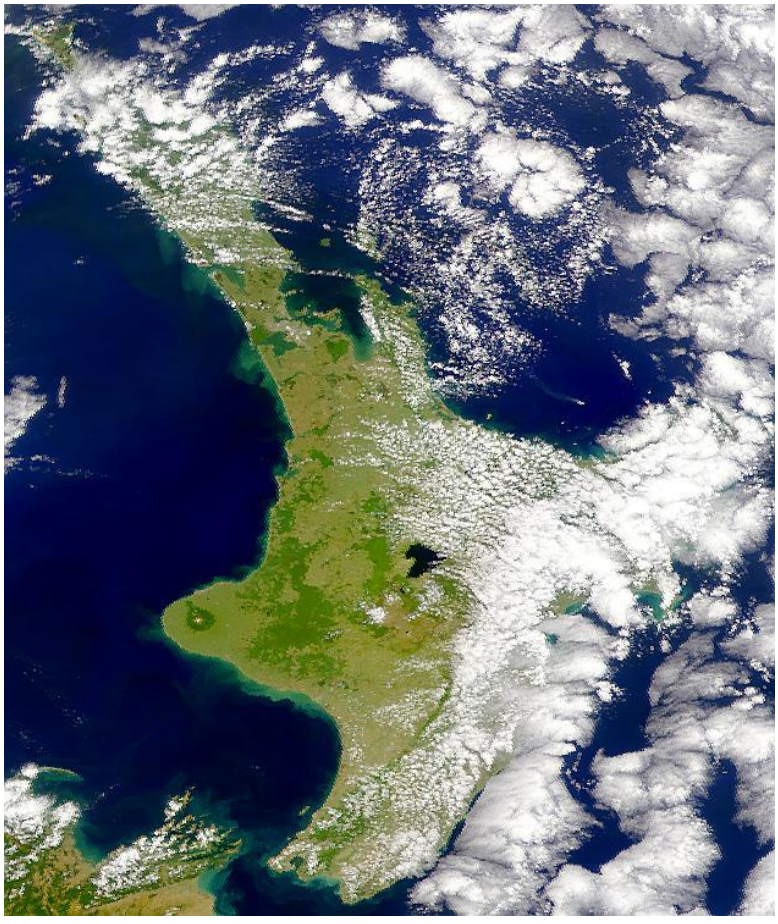
San Cristobal Volcano, Nicaragua

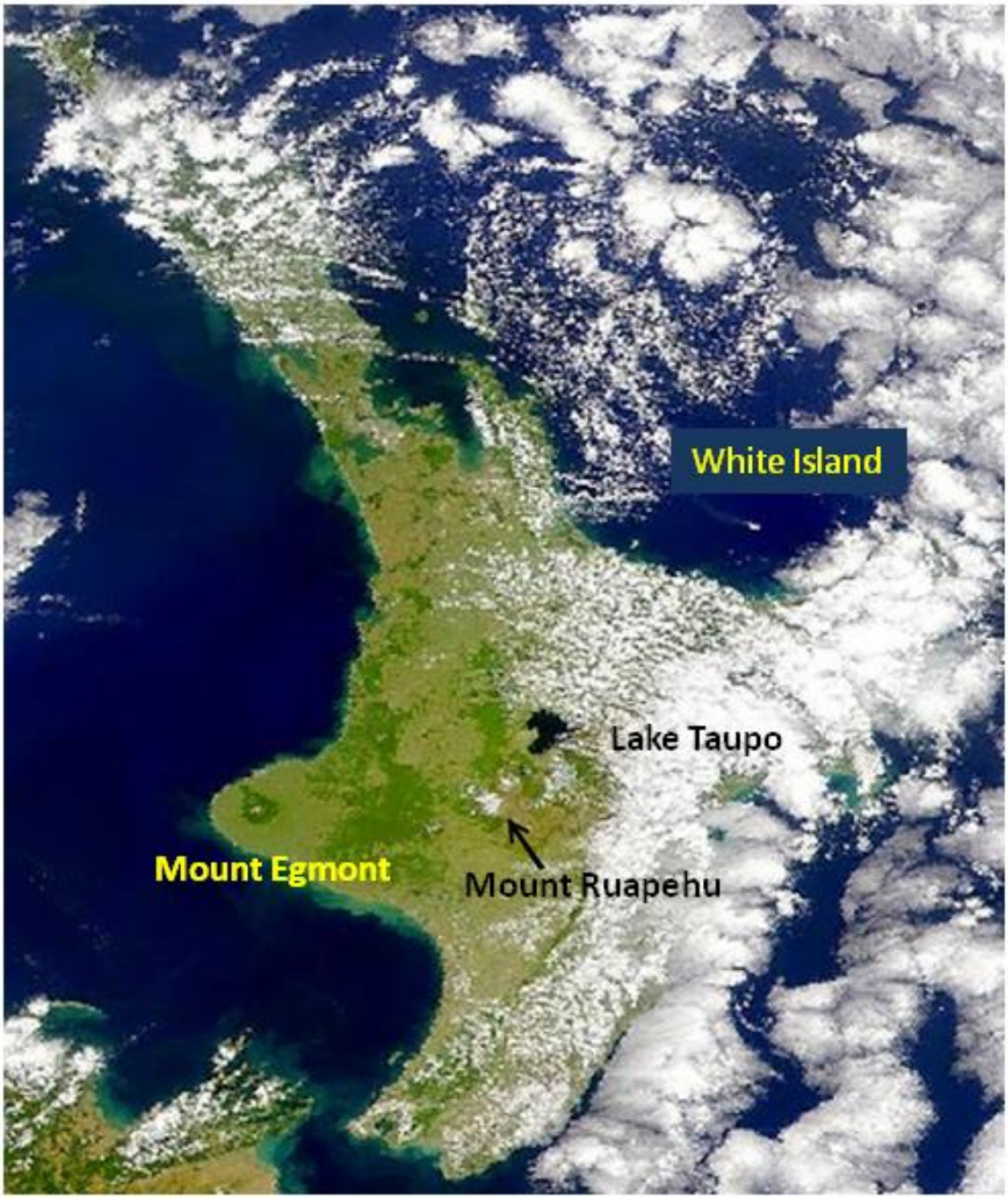
Two views of a long plume from San Cristobal volcano in Nicaragua, drifting westward over the Pacific Ocean. These views were obtained two days apart (February 23 and 25, 2000), and look slightly different due to a slight difference in the observation angle.

San Cristobal volcano (Smithsonian Institution Volcanism Program)

North Island, New Zealand

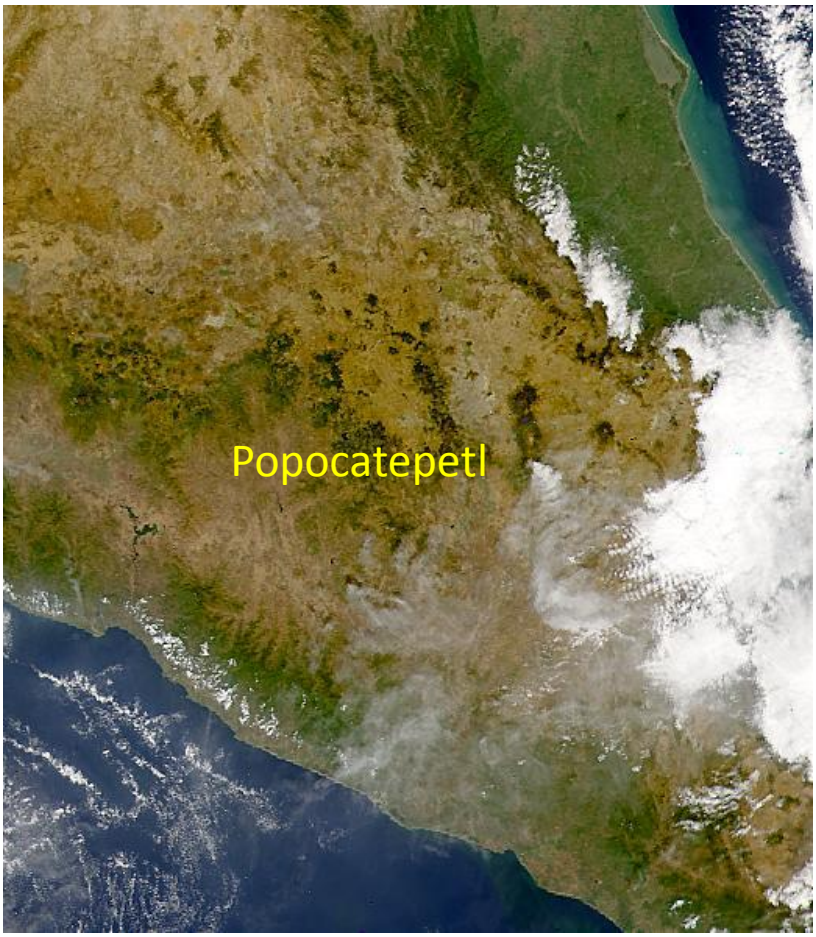
This SeaWiFS image from February 1, 1999, shows the entire North Island of New Zealand. (A larger labeled image is on the next page.)In the center right of the image, in the "Bay of Plenty", a thin plume of gas can be seen drifting from White Island, a small and intermittently active volcanic island. On the main island, the patch of white south of Lake Taupo (refer to the map of the Taupo volcanic zone) is Mount Ruapehu, a frequently active stratovolcano that was also a location for the Lord of the Rings movies. Hidden under the clouds to the north of Lake Taupo is the Rotorua hydrothermal area and the Waimangu hydrothermal area. Early in this century, the Waimangu hydrothermal area was the location of the largest geyser in the world. When Waimangu Geyser erupted, in 1900-1904, some of its eruptions were over 500 meters high. (The current "largest geyser in the world" is considered to be Steamboat Geyser in Yellowstone National Park, but it doesn't erupt very often.) Also note that Lake Taupo is a lake contained in a volcanic caldera. The Lake Taupo volcano has erupted as recently as 181 A.D., an extremely large and violent eruption. On the southwestern end of the island is the isolated Mount Egmont, also called Mount Taranaki.




White Island
Lake Taupo
Mount Egmont
Mount Ruapehu

Popocatepetl, Mexico

On December 18-19, 2000, Popocatepetl volcano in Mexico, which is near Mexico City and has been in a state of mild activity for several years, had an elevated level of activity. SeaWiFS observed the puffing plume of ash from a position almost directly above the volcano.



Here's what the volcano looked like from the ground as the sun was setting, captured by the monitoring of Centro Nacional de Prevencion de Desastres (CENAPRED).

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